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SIMULTANEOUS MUSIC RECORDING APPARATUS FOR VIDEO RECORDER

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SIMULTANEOUS MUSIC RECORDING APPARATUS FOR VIDEO RECORDER

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[Amendments have been incorporated into the translation.]

Claims

/2*

1. A simultaneous music recording apparatus for a video recorder that is a simultaneous music recording apparatus that controls the recording of music that plays simultaneously with the recorded image of the recording apparatus, and which is equipped with a performance means that automatically plays songs based on song performance data, a control to instruct the performance means to start performance, a control signal transmission means that generates a control signal that expresses the instruction to start music performance corresponding to the operation of the control,

* [Numbers in the margin indicate pagination of the original foreign text.]

and transmits said control signal to the video recorder so that the video recorder records said control signal at the recording position corresponding to the image being recorded at the point at which the start performance instruction was given, a first control means that performs control during video recording to instruct the performance means to start performance corresponding to operation of the control, and so that performance by the performance means is stopped in synchronization with the video recorder stopping recording, and so that performance by the performance means restarts from the stop position in synchronization with the video recorder starting recording, and a second control means that performs control during video playback so that performance by the performance means is started according to the control signal that is read out together with the video signal from the video recorder.

2. A simultaneous music recording apparatus for video recorder that is a simultaneous music recording apparatus that controls the recording of music that plays together with the recorded image of the recording apparatus, and which is equipped with a performance means that automatically plays songs based on song performance data, a control to instruct the performance means to start performance, a performance data transmission means that sequentially transmits performance data for a song being played by the performance means to the video recorder so that the video recorder records the song performance data at the recording position corresponding to the video image being recorded during performance by the performance means, and a control means that performs control to stop performance by the performance means in synchronization with the video recorder stopping recording, and restart performance by the performance means from the stop position in synchronization with the video recorder starting to record.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to a simultaneous music recording apparatus for video recorders that is linked with a video recorder, such as the video recorder built into a video camera, and which records background music, etc. to be played with the recorded video image simultaneously with the video recording.

[0002]

Prior art

Normally, to have background music (hereinafter abbreviated BGM) play together with images taken with a video camera with built-in video recorder (hereinafter, video camcorder), the BGM is recorded onto an audio track at the same time that the video is being shot, and a common method used for this kind of recording is to carry an audio CD player or cassette player together

with the video camcorder and simultaneously play music on the audio player while shooting with the video camcorder, mixing the input audio from the external microphone on the video camcorder to record the playback audio on the video camcorder audio track.

[0003]

Problems to be solved by the invention

Shooting with a video camcorder normally progresses by shooting one scene, temporarily pausing the video camcorder, and then shooting the next scene after some time has lapsed, and ultimately playing back these multiple scenes linked together as a single video scene during playback. The background music then plays as continuous music throughout the entire video of the various scenes.

[0004]

In order to realize this with the past recording method, it was necessary to shoot video by simultaneously stopping the audio player whenever the video camcorder was stopped when shooting one scene, and then run the audio player simultaneous with the video camcorder when shooting the next scene in order to produce continuous playback music.

[0005]

However, when this recording method was performed using this technique, it was difficult to perfectly match the timing of starting/stopping the video camcorder and audio player due to the complexity of the operation, so that the background music was not continuous at the scene transitions during playback of the recorded video.

[0006]

Structures that would automatically synchronize the starting/stopping of the video camcorder and audio player were also considered, but it would be difficult with the existing technology to avoid producing noise at the transitions of starting/stopping the audio player, which noise would get mixed into those transitions during playback of the recorded video as "pops" in the background music.

[0007]

The purpose of this invention is to address these problems so that BGM, etc. can be simultaneously recorded during video shooting, and music can continue seamlessly even while scenes are changing.

[0008]

Means to solve the problems

Figure 1 is an explanatory drawing of the basic principles of the simultaneous music recording apparatus for video recorder of this invention, which controls the recording of music that plays together with the video recorded by the video recorder. In order to solve the problems described above, one embodiment of the simultaneous music recording apparatus for video recorder of this invention is equipped with a performance means that automatically plays songs based on song performance data, a control to instruct the performance means to start performance, a control signal transmission means that generates a control signal that expresses the instruction to start music performance corresponding to the operation of the control, and transmits said control signal to the video recorder so that the video recorder records said control signal at the recording position corresponding to the image being recorded at the point at which the start performance instruction was given, a first control means that performs control during video recording to instruct the performance means to start performance corresponding to operation of the control, and so that performance by the performance means is stopped in synchronization with the video recorder stopping recording, and so that performance by the performance means restarts from the stop position in synchronization with the video recorder starting recording, and a second control means that performs control during video playback so that performance by the performance means is started according to the control signal that is read out together with the video signal from the video recorder.

[0009]

This simultaneous music recording apparatus operates linked with the video recorder, whereby the operator uses the control to start automatic performance by the performance means at the indicated song performance timing and send a control signal indicating the start of performance to the video recorder. The video recorder records the control signal at the recording position corresponding to the video image in the recording at the time at which the start of performance was indicated. Furthermore, during video recording, the first control means stops performance by the performance means in synchronization with the video recorder stopping video recording, and restarts performance by the performance means at the stop position in synchronization with the video recorder starting video recording. The second control means starts performance by the performance means according to the control signal that has been read out together with the video recording signal by the video recorder. This allows the song that was playing as the background music during video recording to be automatically played back during playback of the video recording with the same correlation between the recorded video image and

/3

the background music, moreover allowing it to be heard as continuous music during playback, regardless of the video recorder being started and stopped during video recording.

[0010]

The simultaneous music recording apparatus for video recorder of this invention, as another embodiment, is equipped with a performance means that automatically plays songs based on song performance data, a control to instruct the performance means to start performance, a performance data transmission means that sequentially transmits performance data for a song being played by the performance means to the video recorder so that the video recorder records the song performance data at the recording position corresponding to the video image being recorded during performance by the performance means, and a control means that performs control to stop performance by the performance means in synchronization with the video recorder stopping recording, and restart performance by the performance means from the stop position in synchronization with the video recorder starting to record.

[0011]

The performance means automatically plays back a song based on the performance data of the song, and the performance data transmission means sequentially transmits performance data for the song being played. The video recorder records the performance data for the song being played by the performance means at the recording position that corresponds with the video image being recorded as it is played. The control means performs control to stop performance by the performance means in synchronization with the video recorder stopping video recording, and restarts the performance by the performance means from the stop position in synchronization with the video recorder starting video recording. In this way, the performance data for the song that was playing as background music during video recording is recorded in the recorded video image on the video recorder in correlation with the video image at each point in time. Thus, if these performance data are read together with the video signal and automatically played by the performance means during playback, the song that was playing as background music during video recording can be automatically played during video playback with the same correlation between the recorded video image and the background music as during video recording, and moreover can be heard as continuous music during playback, regardless of video recording by the video recorder being started and stopped during video recording.

[0012]

Embodiments of the invention

Embodiments of this invention will be described below, referring to the attached figures. Figure 2 shows the block structure of a simultaneous music recording apparatus for a video recorder (hereinafter referred to in the embodiments of this invention simply as a simultaneous recorder) as an embodiment of this invention. Figure 3 also shows an example of the condition of mounting the simultaneous recorder to the video camcorder. As shown in Figure 3, the simultaneous recorder 31 is attached and mounted by means of a screw 33 on the bottom of the video camcorder 30. In addition, signal lines are connected between input terminals and output terminals on each. An earphone may also be connected to this simultaneous recorder 31, as needed.

[0013]

As shown in Figure 2, the simultaneous recorder 31 is equipped with input and output terminals with output terminals 13, 14 for the left and right audio signals, input terminals 15, 16 for left and right input signals, a video signal input terminal 17, an earphone output terminal 18, and a mixed audio output terminal 19, and signal lines are connected so that left and right audio signals output from the output terminals 13, 14 are input to the left and right audio input terminals on the video camcorder 30, and the left and right audio signal and the video signal from the video camcorder 30 are respectively input to the audio input terminals 15, 16 and video input terminal 17.

[0014]

The various structural elements of this simultaneous recorder 31 will be described below. The controller 1 is a circuit constructed to include a CPU (central processing unit) that enables control of the entire device, and controls the operation of a sequencer 3 according to the operation of a control group 2 and starting and stopping of the video camcorder 30, as will be described below.

[0015]

The control group 2 comprises selector buttons that select and play the BGM that is to play with the recorded video image, a stop button that stops performance, and a mode selection switch. Performance of a BGM song is started at the same time that one of these selector buttons is pressed to select a BGM song.

[0016]

The sequencer 3 is controlled by the controller 3 to start performance of a specified BGM song (START), stop performance (STOP), and continue-start performance (CONTINUE-START). This sequencer 3 is constituted to notify the controller 1 of its status whether or not it is playing. The sequencer is also constituted to store the position at which performance is stopped when a stop performance instruction is given, and to restart performance from that stored stop position when an instruction is given to continue-start performance. "Continue-start" (CONTINUE-START) in this embodiment refers to the operation of restarting performance from the position at which performance was stopped.

[0017]

A song data ROM 4 stores a multiplicity of data for BGM songs to be played by the sequencer 3 (performance data). These performance data are recorded as MIDI data in this embodiment. A sound source 5 actually generates music by driving the sequencer 3. In this embodiment, music is generated according to a MIDI signal transmitted from the sequencer 3.

[0018]

A microphone 10 is for recording external sound, and recorded sound is supplied to the audio input terminal (right) on the video camcorder 30, and supplied to a mixer 6, via an amplifier 11. The mixer 6 is a circuit that mixes and then externally outputs the sound captured by the microphone 10 or the audio output (right) from the video camcorder 30 with the BGM from the sound source 5.

[0019]

The earphone output terminal 18 is a terminal for connecting an earphone for monitoring the mixed sound of the BGM sound from the sound generator 5 and the input sound from the microphone 10 that is output by the mixer 6. In addition, the audio output terminal 19 is an output terminal to output the mixed sound of the BGM sound and original audio (playback audio from the video camcorder) output from the mixer 6 during playback. /4

[0020]

An encoder 8 is a circuit that converts the control signal for simultaneous recording of BGM (hereinafter abbreviate as the simultaneous recording signal) that is transmitted from the controller 1 to a signal in a format that can be recorded on the audio track CH1 of the video camcorder 30 (e.g., FSK (frequency shift keying) signal). In addition, a decoder 9 is a circuit that decodes the simultaneous recording signal recorded on the audio track CH1 of the video

camcorder 30 that had been converted by the encoder 8 to its original format and supplies it to the controller 1. Thus, in this embodiment, of the two audio tracks CH1, CH2 on the video camcorder 30, the left channel audio track CH1 is used as the control track for simultaneous recording of the BGM.

[0021]

A synchronization detection circuit 7 is a circuit that detects the presence of synchronization signal (vertical/horizontal video synchronization signal) from the video output signal of the video camcorder 30 and notifies the controller 1. The controller 1 is able to determine on the basis of this notification that the video camcorder 30 is operating if there is a synchronization signal, or that it is stopped if there is none.

[0022]

A detail of the control group 2 is shown in Figure 4. As shown in this figure, the switch buttons numbered (1–8) are selector buttons, and a variety of BGM songs corresponding to these numbers 1 through 8 are stored in the song data ROM 4 described below. Pressing these selector buttons during video recording selects a BGM song and sends an instruction to start BGM performance. The button labeled [STOP] is the stop button, which is pressed to stop the BGM being played. The switch labeled [MODE] is a switch that switches the operating mode of the simultaneous recorder, and can be set to "REC" during video recording or "PLAY" during playback.

[0023]

Next, an overview of the operation of the simultaneous recorder of this embodiment will be described, referring to Figure 5. Figure 5 is an explanatory diagram that shows the condition of recording the start signal and active signal on the audio track CH1 in the recording track of the video camcorder 30 (comprising the video track and left and right audio tracks) together with the operation of the sequencer 3 on the time axis, wherein (A) shows a circumstance during video recording and (B) shows a circumstance during playback. Namely, (A) shows a circumstance in which recording was paused during video recording after scene A was recorded on the video track, and then recording of scene B was restarted after some time had lapsed, and (B) shows a circumstance in which scene A and scene B recorded on the video track are continuously played back.

[0024]

(Video recording operation) First, the video recording operation will be described. In this case, the mode selection switch on the simultaneous recorder 31 is set to "REC". During video recording with the video camcorder 30, the scene captured by the camera is recorded on the video track and the sound input from the microphone 10 is recorded on the audio track CH2.

[0025]

(1) When video recording by the video camcorder 30 is started, the video signal output from the video camcorder 30 is input to the simultaneous recorder 31 and provided to the synchronization detection circuit 7. When the synchronization detection circuit 7 detects a synchronization signal, it notifies the controller 1 that "there is a synchronization signal," and the controller 1 determines that the video camcorder 30 is recording video.

[0026]

(2) When one of the selection buttons in the control group 2 is pressed during video recording by the video camcorder 30, the controller 1 indicates the song number selected by the selection button to the sequencer 3 and instructs it to start performance. The controller 1 also sends a start signal containing the song number information to the encoder 8.

[0027]

(3) The encoder 8 converts the start signal transmitted from the controller 1 into a signal (FSK signal) that can be recorded on the audio track of the video camcorder 30 and transmits it to the input terminal for audio track CH1 on the video camcorder 30.

[0028]

(4) The video camcorder 30 records the signal from the encoder 8 to the audio track CH1 (left) in real time. Thus, at the point at which the selection button was pressed while recording video scene A, a start signal is recorded at the position on audio track CH1 corresponding to the video image at that point. In this way, a start signal and an active signal, explained below, are recorded on the audio track CH1 as simultaneous recording signals (signals used to control operation of the sequencer during video playback).

[0029]

(5) Meanwhile, external audio from the microphone 10 is recorded on audio track CH2 (right).

[0030]

(6) In addition, the performance sound of the BGM song from the sound source 5 and the external audio from the microphone 10 are mixed by the mixer in the simultaneous recorder 31 and output as audio. The user can monitor this in the earphone 32.

[0031]

(7) When a selector button is pressed and performance of the BGM song is started by the sequencer, the controller 1 periodically transmits an active signal to the encoder 8. This active signal is also sent through the encoder 8 to the video camcorder 30 and is recorded there on an audio track CH1. Thereafter, active signals are recorded at a set time interval. This active signal is a signal that indicates that a BGM song is being played during recording, i.e. that a BGM song will be played during playback of the video image.

[0032]

(8) When video recording by the video camcorder 30 is paused, a synchronization signal is no longer detected by the synchronization detection circuit 7, and the controller 1 is notified that "there is no synchronization." When the controller 1 determines that video recording by the video camcorder 30 has been interrupted, it instructs the sequencer to stop playing.

[0033]

(9) When video recording by the video camcorder 30 is restarted to record scene B, the synchronization detection circuit 7 again detects the synchronization signal, whereby the controller 1 determines that the video camcorder 30 is recording and instructs the sequencer 3 to resume playing. The sequencer restarts playing, continuing from the position at which it stopped playing when recording of scene A was paused. In other words, the controller performs control to match the operation of the video camcorder 30 and operation of the sequencer 1.

/5

[0034]

(10) Meanwhile, if the stop button in the control group 2 is pressed during video recording, as shown in scene B of 5(A), the controller 1 stops the sequencer 3 playing and stops transmitting the active signal that it had been periodically sending up until then. Thereafter, the active signal is not recorded on the video camcorder 30 audio track CH1. In other words, audio track CH1 is blank from that point on until the next time a selector button is pressed.

[0035]

The segment on which an active signal is thus continuously recorded is the segment on which BGM was played during video recording, and the point at which this active signal was cut is the point at which the stop button was pressed during recording and performance of the BGM was stopped. The presence of this signal is monitored during playback and driving of the sequencer 3 is controlled so that the BGM song is played/stopped in the same condition as during video recording.

[0036]

(Operation during playback) The operation during playback will be described next. In this case, the mode selection switch on the simultaneous recorder is set to "PLAY".

[0037]

(1) When video images are played back on video camcorder 30 for the first time, the video track image signal and audio signals on the left and right audio tracks CH1, CH2 are reproduced, of which, the audio signal on audio track CH2 (right) is input to the mixer 6 and the simultaneous recording signal on audio track CH1 (left) is input to the decoder 9. The decoder reconverts the simultaneous recording signal that was recorded on audio track CH1 and sends the resulting start signal to the controller 1.

[0038]

(2) The controller extracts the song number from the start signal that has been sent to it and transmits that to the sequencer 3, and instructs the sequencer 3 to start performance of the BGM song of that song number. Thereafter, the sequencer 3 will continue to play as long as the active signal is not cut.

[0039]

(3) Meanwhile, the audio on audio track CH2 is mixed with the BGM audio from the sound source 5 and output as audio. In other words, the sound recorded by the microphone 10 during recording and the BGM performance sound are heard together as mixed audio.

[0040]

(4) After the start signal, the active signal is periodically provided from audio track CH1, through the decoder 9, and to the controller 1. During the time that this active signal is being sent without interruption, the controller 1 causes the sequencer 3 to continue to play the BGM.

[0041]

(5) When playback of audio track CH1 reaches the location at which the stop button was pressed during audio recording and transmission of the active signal was stopped (the place at which playing of the BGM was stopped), the active signal stops being sent to the controller 1. The controller 1 waits a specified time from when the last active signal was sent, and when it detects that the next active signal has not come, the controller 1 instructs the sequencer 3 to stop playing.

[0042]

(6) If the controller waits for the next start signal to come and receives a start signal, operation is repeated from (1).

[0043]

Since the time between scene A, when recording was paused during video recording, and scene B is zero during video playback, the point at which video recording was paused and the point at which it was restarted are connected, and therefore scene A and scene B are continuously played back. In precisely the same way, the point at which the sequencer 3 was stopped playing and the point at which performance was restarted match at the transition between scene A and scene B during audio recording, the segment of audio track CH1 corresponding to scene A and the segment corresponding to scene B are tied together during playback so that the active signal is periodically reproduced, whereby the sequencer plays so that performance is continuous even at the transition between scene A and scene B, maintaining the synchronization between the progress of sequencer performance and the progress of the video images of the scenes.

[0044]

Next, details of the processing by the controller will be described referring to the flow charts in Figures 6-12. These flow charts detail the processing in the CPU in the controller 1. The various figures will be described below.

[0045]

Figure 6 illustrates a routine that is executed first when the power is turned on. The variables used for the subsequent processing are initialized and the sequencer is initialized, etc. as initialization processing (step A).

[0046]

Next, a timer interrupt routine is started to periodically count up the time counter t. The interrupt period of the internal timer (not shown) in the controller 1 is specified and the disable

interrupt flag is canceled. Thereafter, the timer interrupt routine shown in Figure 7 is periodically executed at the designated interrupt period (step B). For instance, if 10 ms is specified as the interrupt period, the routine in Figure 7 is executed every 10 ms.

[0047]

The status of the mode selection switch is then checked (step C), and if the mode selection switch is on the "REC" side, processing moves to a REC routine (step D), or moves to a PLAY routine if it is on the "PLAY" side (step E).

[0048]

The timer interrupt routine in Figure 7 described above is executed every time a timer interrupt is generated. First, the value of variable t is incremented by 1 (step B1). Then, variable t is compared to a specified threshold value t_{max} so that it does not overflow (step B2), and if variable t exceeds the threshold value t_{max}, the threshold value t_{max} is substituted for variable t (step B3).

[0049]

Figures 8 through 10 are the REC mode routine that is executed in the "REC" mode. The variables used in this routine are the play flag, continue-start flag, and interval time. The /6
significance of these variables is explained below.

[0050]

The play flag is a flag that expresses whether the sequencer is playing or not playing, and is set to "1" if the sequencer is instructed to start or continue-start playing, or to "0" if it is instructed to stop playing.

[0051]

The continue-start flag is a flag that indicates whether to enable continue-start, and is set to "1" when it is enabled and "0" when it is disabled. In other words, when stop playing is indicated due to video recording being stopped (synchronization signal is cut), it is set to "1" to enable continue-start. When stop playing is indicated due to the stop button being pressed, it is left at "0" so that continue-start is disabled.

[0052]

Interval time T_{int} stores the time interval at which the active signal is sent. In this case, when the interrupt routine in Figure 7 is called at an interval o f 10ms, if T_{int}=10, an active signal will be sent every 100ms. This value is a constant.

[0053]

The details of the REC mode routine will be explained below, following Figures 8-10. When the REC mode routine is started, first the play flag and continue flag are each initialized to "0" (step D1). Next, there is a check for notifications from the synchronization detection circuit 7 (step D2) to determine whether there is a synchronization signal (i.e., if video recording is on or paused) (step D), and then the status of the play flag is determined according to the presence of a synchronization signal ("yes" or "no") (steps D4, D23).

[0054]

The flow of processing significantly varies according to the presence of this synchronization signal and the status of the play flag, branching into the following 4 cases.

[0055]

(Case 1) Synchronization signal "yes", play flag = "1" Branch to step D5
Video recording is underway and the sequencer is playing.
(Case 2) Synchronization signal "yes", play flag = "0" Branch to step D13
Video recording is underway and sequencer performance is stopped.
(Case 3) Synchronization signal "no", play flag = "1" Branch to step D24
The sequencer is playing and video recording has been paused.
(Case 4) Synchronization signal "no", play flag = "0" Branch to step D28
Sequencer performance is stopped and video recording has been paused.

[0056]

The flow chart will be explained below in the sequence of video camcorder 30 operation. First, assume that video recording by the video camcorder 30 is started without a BGM song playing. In this case, since the synchronization signal is "yes" and the play flag = "0", processing branches to case 2 (sequencer performance is stopped and video recording is underway).

[0057]

(Case 2) First, there is a check for whether a selector button in the control group 2 has been pressed (step D13), and if one has been pressed, the following sequence of processing is executed. Namely, the song number corresponding to the number of the selector button that was pressed is acquired (step D14), and the a start signal containing that song number as data is sent to the encoder 8 (step D15). Meanwhile, the song to be played is specified by sending the song number to the sequencer 3 and the sequencer 3 is instructed to start playing (step D16). Thus, the sequencer 3

starts playing the selected performance song. Next, variable t is initialized to "0" in order to periodically generate an active signal from the point at which performance was started (step D17). In addition, the play flag is set to "1" to indicate that the sequencer 3 is playing. Thereafter, processing returns to detecting the presence of a synchronization signal (step D2) and subsequent processing is repeated (hereinafter referred to as loop processing) to monitor changes in status. The above processing sets up a status in which the video recording by the video camcorder 30 is underway and a BGM song is playing.

[0058]

After returning from this (case 2) to step D2 of detecting the presence of a synchronization signal, since the play flag is determined to be "1" at step D4, subsequent loop processing branches to case 1 (sequencer is playing and video recording is underway).

[0059]

(Case 1) First, variable t is compared with the interval time T_{int} to determine if $t \geq T_{int}$ (step D5), and if the answer is "yes", an active signal is set to the encoder 8 (step D6) and variable t is reset to "0" (step D7). If it is "no", processing regarding the transmission of this active signal jumps to the following processing. Since variable t is periodically incremented by one by the timer interrupt routine, this processing is repeated as a loop, whereby a start signal has been sent, and then an active signal is periodically sent (every time $t \geq T_{int}$).

[0060]

In the subsequent processing, it is checked whether the user has pressed the stop button to stop the BMG song (step D8). If that button is pressed, an instruction of stopping the playback is sent to the sequencer (step D9), and the play flag is set to "0" indicating stop of the playback (step D10). In this way, playback of BMG song is stopped even when video movie 30 is being recorded. If the stop button is not pressed, the process goes to the next step without carrying out the processing regarding stop of the playback.

[0061]

In the subsequent processing, a check is made for notification from the sequencer 3 (step D11), and if the sequencer 3 has finished playing the song, the play flag is set to "0" to indicate that performance has been stopped. This creates a status in which video recording by the video camcorder 30 is underway, but the BGM song has finished playing. If performance has not been

finished, the processing for case 1 is ended without performing processing related to stopping performance (i.e., with the play flag left as it was), processing returns to the step of detecting the presence of the synchronization signal, and loop processing is repeated.

[0062]

Once the video camcorder 30 has operated as described above and video recording is stopped, the synchronization detection circuit 7 is no longer able to detect a synchronization signal. Thus, the synchronization signal is determined to be "no" in the step to determine detection of the presence of a synchronization signal (step D2). When video recording is stopped while a BGM song is playing, since the play flag is set to "1" to indicate that it is playing, processing branches to case 3 (sequencer is playing and video recording has been paused) (step D23).

[0063]

(Case 3) When the video camcorder 30 stops recording video, the controller 1 instructs the sequencer 3 to stop playing (step D24) and stores the value for the time variable t in a register as stored value t_0 (step D25). The continue-start flag is then set to "1" to indicate that continue-start is enabled (step D26) and the play flag is set to "0" to indicate that performance is stopped (step D27). Thus, preparations are made for when performance is restarted the next time a synchronization signal comes (video recording is resumed). Loop processing is then repeated, returning to step D2, to monitor for a synchronization signal.

[0064]

When video recording by the video camcorder 30 is resumed from this aforementioned state, after setting synchronization signal to "Yes" and the play flag = "0", processing moves to (case 2).

[0065]

If it is determined at step D13 in the case of (step 2) that a selector button has not been pressed, processing branches to a different flow from that described above to determine the status of the continue-start flag (step D18). Because this continue-start flag has been set to "1" by the processing in (case 3) to indicate that continue-start has been enabled, the controller 1 instructs the sequencer 3 to continue-start (step D19). Thus, the sequencer 3 resumes playing the interrupted BGM song in synchronization with the resumption of video recording. In addition, the stored value t_0 stored in the register is reset to the variable t (step D20) so that the active signal is periodically generated after restarting (i.e., so that it is periodically generated during playback from the time the last active signal was generated before play was paused). Next, the continue-start flag set to "0" to

indicate that continue-start is disabled and processing returns to processing to detect the presence of the synchronization signal (step D2).

[0066]

On the other hand, in the case the operation to play the BGM song is not performed after resuming video recording, the continue-start flag remains set to "0" as it was when it was initialized at step D1. Consequently, when the continue-start flag is determined to be "0" at the decision at step D18, above, processing in (case 2) is stopped in that condition and returns to the processing to detect the presence of the synchronization signal (step D2).

[0067]

Because the play flag is set to "0" when the operation to play a BGM song is not performed during video recording, or if a BGM song is stopped playing by pressing the stop button, if video recording is topped in this condition, the synchronization signal is set to "No" and the play flag is set to "0", and processing branches to case 4.

[0068]

(Case 4) In this case, in which neither the sequencer 3 nor the video camcorder 30 is operating, the mode selection switch is checked (step D28) and if there is no change in the mode (if it stays in the "REC" mode), processing returns to detecting the presence of the synchronization signal (step D2) without changing anything. If the mode is switched to "PLAY", processing moves to the PLAY routine described below.

[0069]

Figures 11 and 12 show the PLAY mode routine, which executes the operation of the simultaneous recorder during video playback, i.e., when in the PLAY mode. The roles and significance of the variables used in this routine are the same as they were in the REC mode routine described above.

[0070]

This is described below as the process of rewinding the video recorded by the video camcorder 30 to the beginning and playing back the video. If the mode selection switch on the simultaneous recorder is switched to the "PLAY" mode, this PLAY mode routine is executed, but the play flag is initialized to "0" (step E1).

[0071]

There is a check to see whether a signal is coming from the decoder 9 (step E2) and if there is a signal, that signal is checked to see if it is a start signal (step E7). If it is a start signal, the following processing starts performance of the BGM song from that position. Namely, the status of the play flag is checked (step E8). Since the play flag = "0" at this point, performance of the BGM song has not yet started, and therefore, the song number information contained in the start signal received from the decoder 9 is extracted (step E9), that song number is sent to the sequencer 3 to designate the song to be played, and then the sequencer 3 is instructed to start playing (step E10). Thus, the sequencer 3 starts to play the BGM song. Furthermore, the play flag is set to "1" to indicate that performance is underway (step E11).

[0072]

Since the play flag = "1" when the play flag status is subsequently checked (step E14), detection of the presence of a synchronization signal is performed next (step E16). Since there is no video signal, because video playback has been stopped or because a segment is being played on which no video signal was recorded, etc., if there is no synchronization signal, an instruction to stop playing is given to the sequencer 3 and the play flag is set to "0". After this processing, or if the synchronization signal = "Yes", the sequencer 3 is further checked to see if it has finished playing a song (step E20). If it has finished, the play flag is set to "0". After this processing, or if the song is not finished playing, processing returns to monitoring the signal coming from the decoder 9 (step E2). /8

[0073]

After a start signal has been received, the signal sent from the video camcorder 30 is an active signal. Therefore, when it is determined that a signal has arrived from the decoder 9 (E2), and that signal is not a start signal (step E7), the signal is checked to see if it is an active signal (step E12). If it is an active signal, the variable t, which monitors the period at which the active signal arrives, is set to "0" to automatically stop performance (step 13). While an active signal is periodically arriving, the flow at step E12 is repeated so that sequencer 3 plays the BGM song in parallel with the video playback.

[0074]

If the signal that has arrived is neither a start signal nor an active signal, execution thereafter returns to step E14 without anything being done. Furthermore, since this simultaneous recorder handles nothing other than the two start and active signals, and essentially no other

signals will come to it, the aforementioned processing to check for the active signal (step E12) is very certain.

[0075]

Thereafter, an active signal arrives periodically and the BGM song is played, but since this means that the BGM song will stop during video playback when the active signal stops, processing is performed in this case to stop the sequencer 3 from playing. This processing will be explained next, according to the flow chart.

[0076]

When no signal comes from the decoder 9 (step E2), the variable t is compared with interval T_{int} to determine if $t \geq 2 \cdot T_{int}$ (step E3). If the decision result is YES, since more than a specified time ($2 \cdot T_{int}$) has passed since the last active signal arrived, it is determined that the active signal was stopped during video recording at that performance position. Therefore, the play flag status is checked (step E4), and if it is "1" to indicate that BGM was being played, the sequencer 3 is instructed to stop playing (step E5) and the play flag is set to "0" (step E6).

[0077]

In other words, in a case where the sequencer is playing and an active signal, which was supposed to have been sent at the time interval T_{int}, has not arrived even after waiting the time ($2 \cdot T_{int}$) (i.e., when there was a $2 \cdot T_{int}$-long blank on the video camcorder 30 audio track CH1), the controller 1 sees this as a signal to stop the performance and stops the sequencer 3.

[0078]

In a case when the sequencer 3 has been stopped, if the BGM song was finished playing, or if it was not being played from the start, etc., the play flag is set to "0". In this case, the play flag = 0 determination is made at step E14, and the status of the mode selection switch is checked at the next step (step E15). If the mode has not been switched (if it is still in "PLAY" mode), execution moves to the next step (step E20) without changing anything. If the mode has been switched to "REC", execution moves to the REC mode routine described above.

[0079]

When the processing in the segment from step E14 through E19 is finished, a check is made for a notification from the sequencer 3 (step E20) and if the sequencer 3 is finished playing a song, the play flag is set to "0".

[0080]

A variety of modifications are possible in the embodiment of this invention. For example, in the embodiment described above, an active signal is periodically sent while a BGM song is being played during video recording, but this invention is not limited to this, and, instead of periodically transmitting an active signal, a pause play signal or stop play signal could be respectively written to the video camcorder audio track when BGM performance is paused or stopped, and the sequencer could be controlled according to these signals during playback.

[0081]

In addition, only the selected song number was included and sent in the start signal for that song in the embodiment described above, but the song number also could be periodically recorded on the audio track in combination with the time lapsed from the start of playing to enable the video camcorder to play a video from the middle. Thus, even if the video camcorder were to play a video from the middle, the sequencer is able to refer to the readout information and play from the location in the BGM song corresponding to that midway starting position.

[0082]

An audio track was used in the embodiment described above as the track for recording the signals to control simultaneous recording, but this invention is not limited to this and these could also be recorded on a control track provided in addition to the video track and audio tracks.

[0083]

Additionally, only data indicating to start performance and stop performance were recorded in the embodiment described above, but the performance data (MIDI data) themselves could be recorded instead. If the BGM were thus recorded as the performance data, the sound source could be driven by the values of the performance data read out during playback, enabling continuous performance without any noise at the scene cuts.

[0084]

The circumstances in which a signal corresponding to the performance data is recorded on audio track CH1 is shown in Figure 13. In this condition, these signals are used in pairs wherein a note generated at "Note ON" is silent at "Note OFF". Figure 13(a) shows an instance in which video recording is paused at the point at which Note ON for music "D" is written to the audio track, and subsequently Note OFF is written for "D" after video recording is restarted.

[0085]

Thus, when video recording is paused during recording, since the music "D" is forcibly stopped at that point at which video recording was stopped, it sounds like the sound was cut off during video recording. However, even if video recording is performed between temporary stops during recording, since the Note ON and Note OFF are recorded linked to the audio track, unrelated to the temporarily paused interval, as shown in Figure 13(b), the sound of music "D" generated by the Note ON is not cut off midway during playback, but continues to play and stops normally with the subsequent Note OFF. /9

[0086]

In this case as well, as in the example embodiment, since control signals to cause the sound source to generate sound are written, without writing the sound signal itself (audio waveform), the "pop" noises at the seams between the point at which recording was paused and the point at which recording was restarted are not generated.

[0087]

In addition, whether video recording by the video camcorder was underway or stopped was detected in the embodiment described above by monitoring a synchronization signal in the video image signal, and operation of the sequencer was controlled according to this. In other words, this simultaneous recorder controls operation of the sequencer by tracking the operation of the video camcorder. However, this invention is not limited to this, and conversely, the operation of the sequencer and the operation of the video camcorder could also be centrally controlled by a controller (CPU) in the simultaneous recorder. For example, if instructions to start/stop video recording, etc., were given by remote control input to the video camcorder, operation of the video camcorder and sequencer could be synchronized even without monitoring the operation of the video camcorder in the simultaneous recorder by means of synchronization detection, etc.

[0088]

Further, since the video camcorder needs time for the mechanical operations from when it is instructed to record video until video recording is actually started in this condition, there may be situations in which operation of the sequencer precedes the video camcorder starting video recording, but in this case, the controller may be configured to perform processing to delay the instruction to the sequencer to start or stop playing by a specified time.

[0089]

There will probably also be cases in which, if video recording by the video camcorder is stopped while video recording is paused, the BGM performance data signal will not be recorded to the end. For instance, there is the case in which video recording by the video camcorder is stopped while the signal expressing "Note ON" in the BGM performance data is being recorded. In this case, the controller could monitor the operation of the sequencer and, if the sequencer is in the middle of generating performance data, such as "Note ON", etc., instruct the video camcorder to stop video recording after waiting for this to be completed.

[0090]

By controlling the start/stop timing of the operation of the sequencer and video camcorder, the controller can prevent the loss of the performance data being recorded.

[0091]

In each of the example embodiments discussed above, the simultaneous recorder of this invention is described as being constructed as a separate device from the video camcorder being used mounted onto the video camcorder, but this invention is of course not limited to this and may also be incorporated into the video camcorder as a single unit. In addition, since the user does not necessarily have to hear the BGM song during video recording, the control signal transmission mechanism that sends the control signal for simultaneous recording can be separated as a stand-alone device from the performance sound generating mechanism of the sequencer and sound source, so that simultaneous recording is accomplished by attaching only the former control signal transmission mechanism to the video camcorder during video recording, and playing the BGM song together with video playback by attaching the latter performance sound generating mechanism only during playback. This would enable the device attached to the video camcorder during video recording to be made smaller and easier to handle.

[0092]

Effect of the invention

With this invention, as described above, BGM songs flowing in the background can be continuous, even at the transitions between scenes in the recorded video image, making it possible to prevent discontinuity in the song and noise from getting mixed in.

Brief description of the figures

Figure 1 is an explanatory diagram of this invention.

Figure 2 is a diagram showing the block structure of a simultaneous music recording apparatus (simultaneous recorder) as an embodiment of this invention.

Figure 3 is a drawing to explain the condition in which the simultaneous recorder of this embodiment is attached to the video camcorder.

Figure 4 is a diagram showing an external view of the control group of the simultaneous recorder of this embodiment.

Figure 5 is a diagram showing the circumstances of recording onto the recording tracks in order to explain the operation of the simultaneous recorder of this embodiment.

Figure 6 is a flow chart of the routine executed when the power is turned on to the simultaneous recorder of this embodiment.

Figure 7 is a flow chart of the timer interrupt routine of the simultaneous recorder of this embodiment.

Figure 8 is a flow chart of the REC mode routine (1/3) of the simultaneous recorder of this embodiment.

Figure 9 is a flow chart of the REC mode routine (2/3) of the simultaneous recorder of this embodiment.

Figure 10 is a flow chart of the REC mode routine (3/3) of the simultaneous recorder of this embodiment.

Figure 11 is a flow chart of the PLAY mode routine (1/2) of the simultaneous recorder of this embodiment.

Figure 12 is a flow chart of the PLAY mode routine (2/2) of the simultaneous recorder of this embodiment.

Figure 13 is an explanatory diagram of the circumstances of recording onto the recording tracks in order to explain the simultaneous recorder of another embodiment of this invention.

Reference numerals

1 Controller (CPU)
2 Control group
3 Sequencer
4 Song data ROM
5 Sound source
6 Mixer
7 Synchronization detection circuit
8 Encoder
9 Decoder
10 Microphone

11 Amplifier

30 Video camcorder

31 Simultaneous recorder

32 Earphone

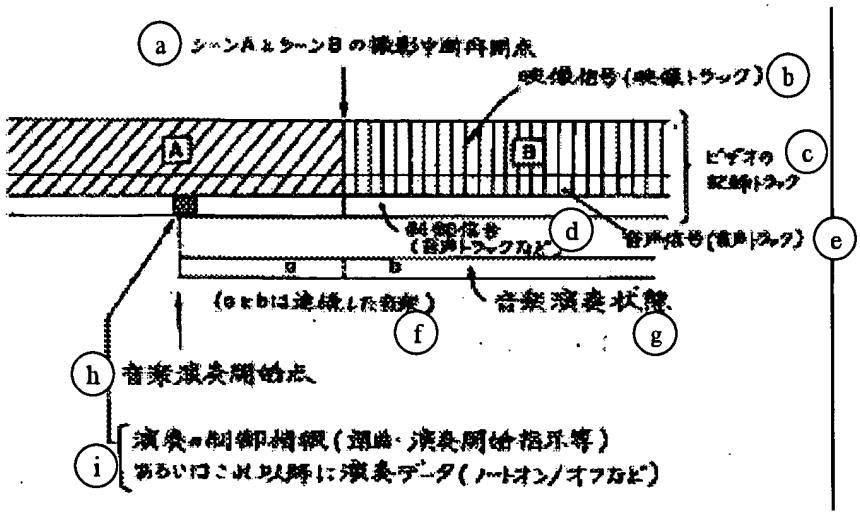

Figure 1

Key:

	a	Point at which shooting was stopped/restarted between scene A and scene B
	b	Video signal (Video track)
	c	Video recording tracks
	d	Control signal (audio track, etc.)
	e	Audio signal (audio track)
	f	(a and b are continuous music)
	g	Music performance status
	h	Start music performance point
	i	Performance control information (song selection, start performance indicator, etc.) or other subsequent performance data (Note ON/OFF), etc.

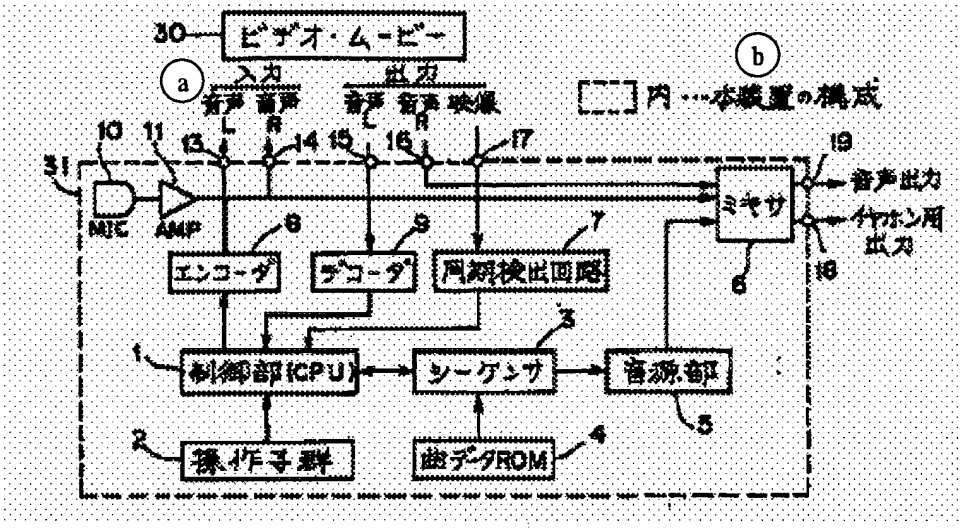

Figure 2. Block structure of embodied apparatus

Key:

a	INPUT	OUTPUT
	Audio L Audio R	Audio L Audio R Video
b	Inside [ ] … Structure of this apparatus	
1	CONTROLLER (CPU)	
2	CONTROL GROUP	
3	SEQUENCER	
4	SONG DATA ROM	
5	SOUND SOURCE	
6	MIXER	
7	SYNCHRONIZATION DETECTION CIRCUIT	
8	ENCODER	
9	DECODER	
18	→ EARPHONE OUTPUT	
19	→ AUDIO OUTPUT	
30	VIDEO CAMCORDER	

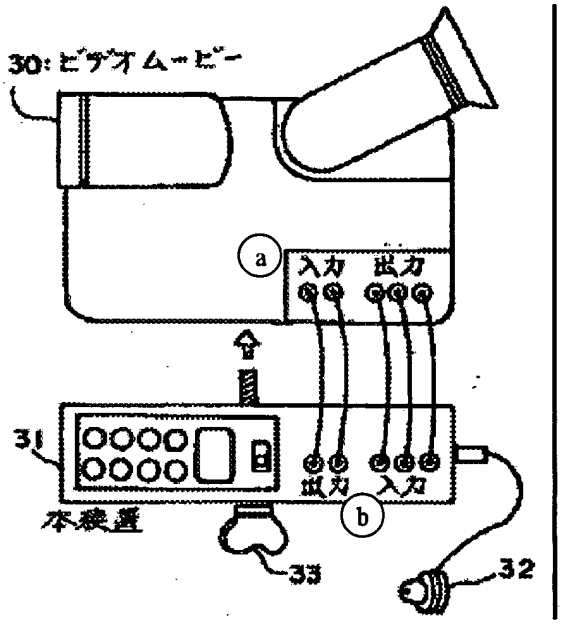

Figure 3. Mounting condition of embodied apparatus

Key: 30 VIDEO CAMCORDER
31 THIS APPARATUS
a INPUT OUTPUT
b OUTPUT INPUT

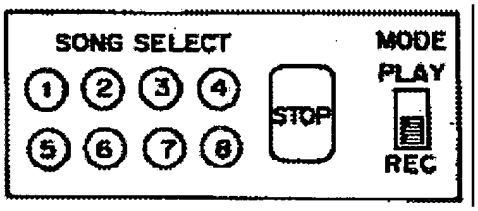

Figure 4. External view of control group

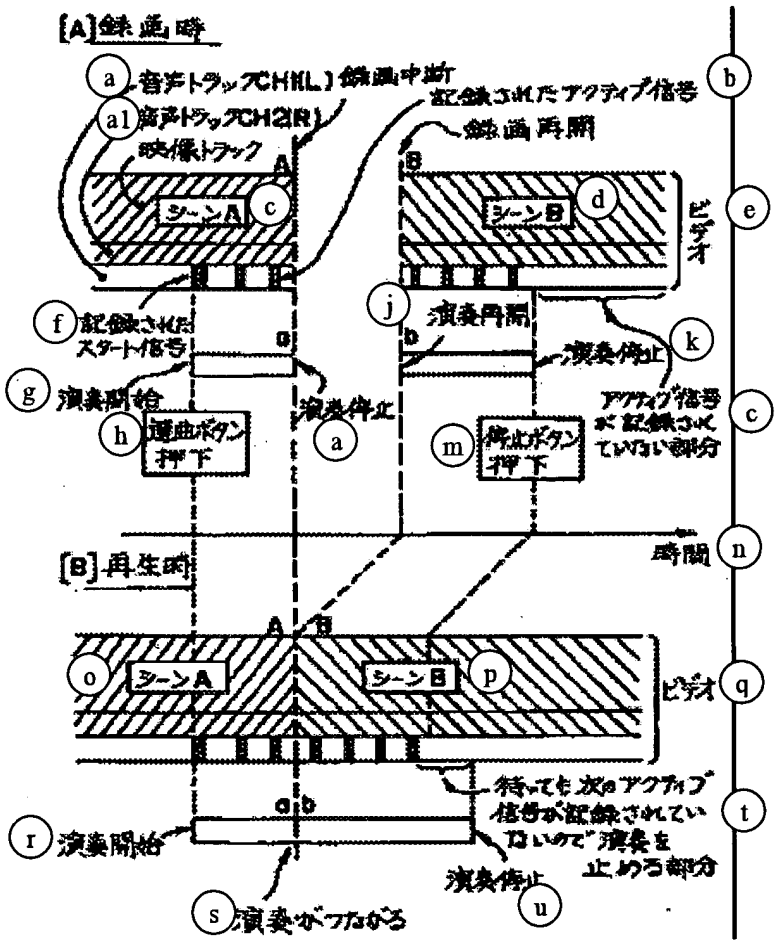

Figure 5

Key:

	[A]	DURING VIDEO RECORDING
	a	AUDIO TRACK CH1 (L) AUDIO TRACK CH2 (R) VIDEO TRACK
	a1	PAUSE VIDEO RECORDING
	b	RECORDED ACTIVE SIGNAL RESTART VIDEO RECORDING
	c	SCENE A
	d	SCENE B
	e	VIDEO
	f	RECORDED START SIGNAL
	g	START PLAY
	h	SONG SELECTOR BUTTON PRESSED
	i	STOP PLAY
	j	RESTART PLAY
	k	STOP PLAY
	L	SEGMENT IN WHICH ACTIVE SIGNAL WAS NOT RECORDED
	m	STOP BUTTON PRESSED

n TIME
[B] DURING PLAYBACK
o SCENE A
p SCENE B
q VIDEO
r START PLAY
s MUSIC PERFORMANCE IS TIED TOGETHER
t SEGMENT IN WHICH BGM PERFORMANCE IS STOPPED BECAUSE, EVEN AFTER WAITING, NEXT ACTIVE SIGNAL IS NOT RECORDED
u STOP PLAY

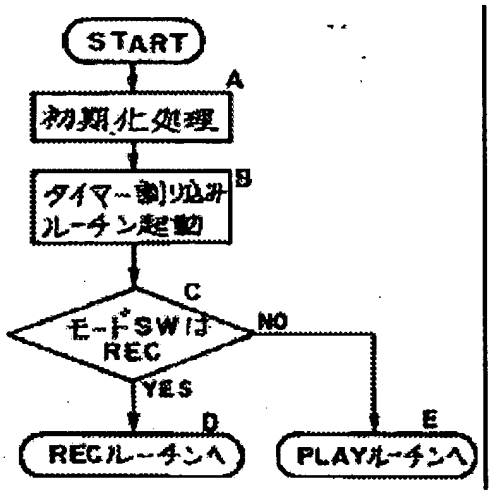

Figure 6. Routine at power-up

Key: A INITIALIZATION PROCESSING
B RUN TIMER INTERRUPT ROUTINE
C MODE SW: REC?
D TO REC ROUTINE
E TO PLAY ROUTINE

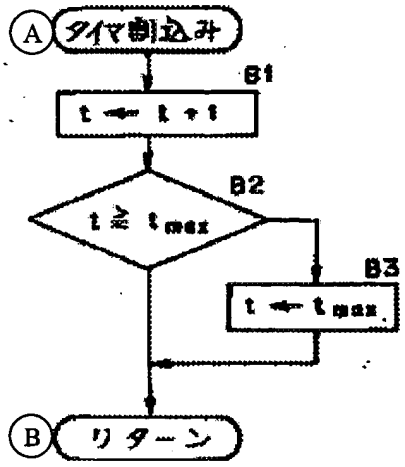

Figure 7. Timer interrupt routine

Key:
- A (TIMER INTERRUPT)
- B1 $t \leftarrow t + 1$
- B2 $t \geqq t_{max}$
- B3 $t \leftarrow t_{max}$
- B (RETURN)

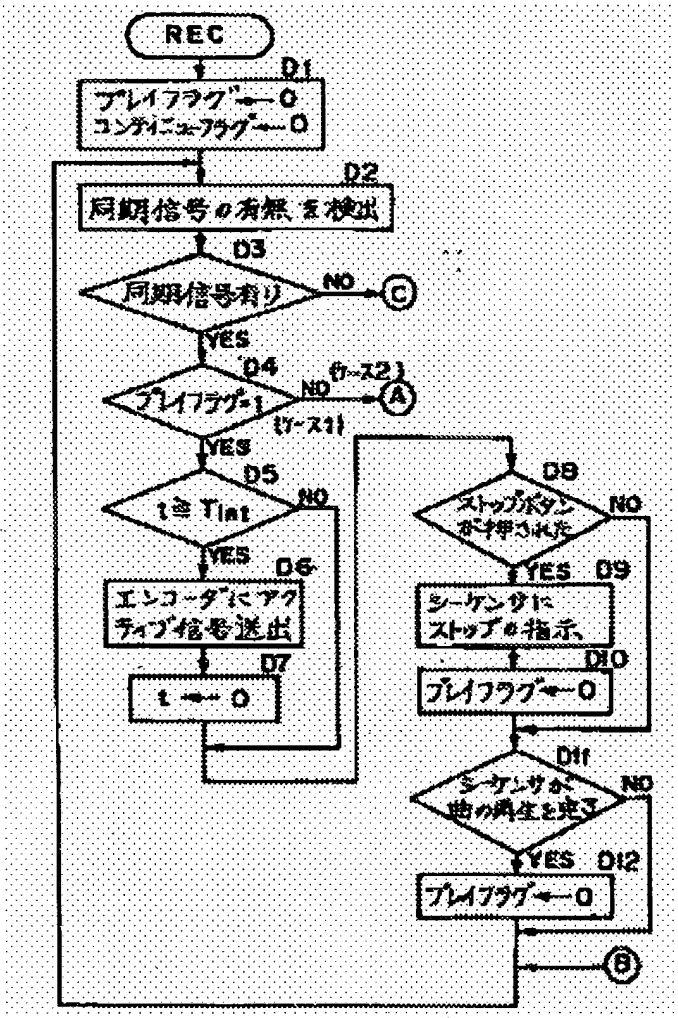

Figure 8. REC mode routine (1/3)

Key:
- D1 PLAY FLAG ← 0
CONTINUE FLAG ← 0
- D2 DETECT SYNCHRONIZATION SIGNAL
- D3 SYNCHRONIZATION SIGNAL?
- D4 PLAY FLAG = 1 ?
- D6 SEND ACTIVE SIGNAL TO ENCODER
- D8 STOP BUTTON PRESSED?
- D9 STOP INSTRUCTION TO SEQUENCER
- D10 PLAY FLAG ← 0
- D11 SEQUENCER DONE PLAYING SONG?
- D12 PLAY FLAG ← 0

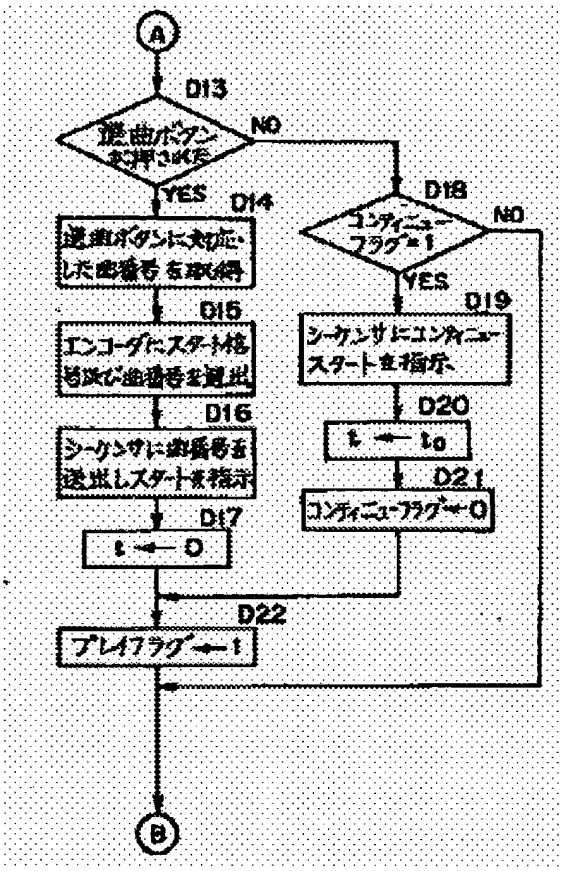

Figure 9. REC mode routine (2/3)

Key:
- D13 SONG SELECTOR BUTTON PRESSED?
- D14 GET SONG NUMBER CORRESPONDING TO SONG SELECTOR BUTTON
- D15 SEND START SIGNAL AND SONG NUMBER TO ENCODER
- D16 SEND SONG NUMBER TO SEQUENCER, INSTRUCT TO START
- D18 CONTINUE FLAG = 1 ?
- D19 INSTRUCT SEQUENCER TO CONTINUE-START
- D21 CONTINUE FLAG ← 0
- D22 PLAY FLAG ← 1

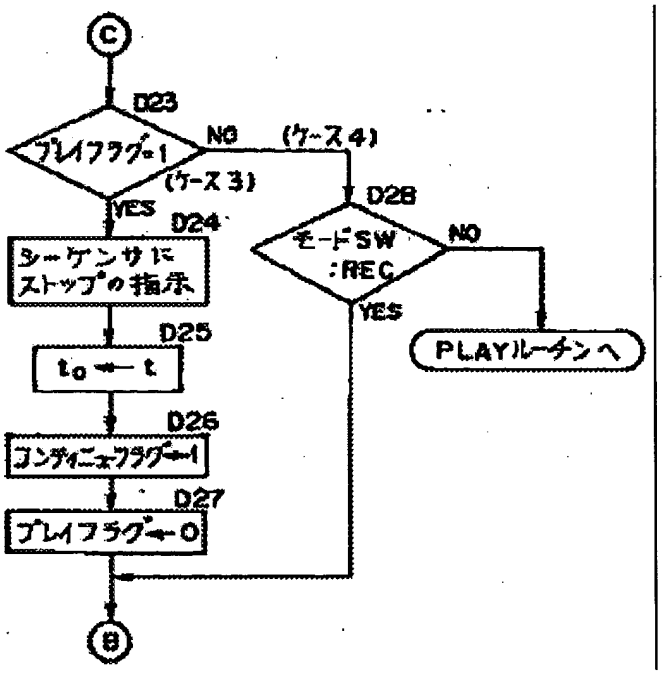

Figure 10. REC mode routine (3/3)

Key: D23 PLAY FLAG = 1 ?
NO (CASE 4)
YES (CASE 3)
D24 INSTRUCT SEQUENCER TO STOP
D26 CONTINUE FLAG ← 1
D27 PLAY FLAG ← 0
D28 MODE SW: REC?
NO (TO PLAY ROUTINE)

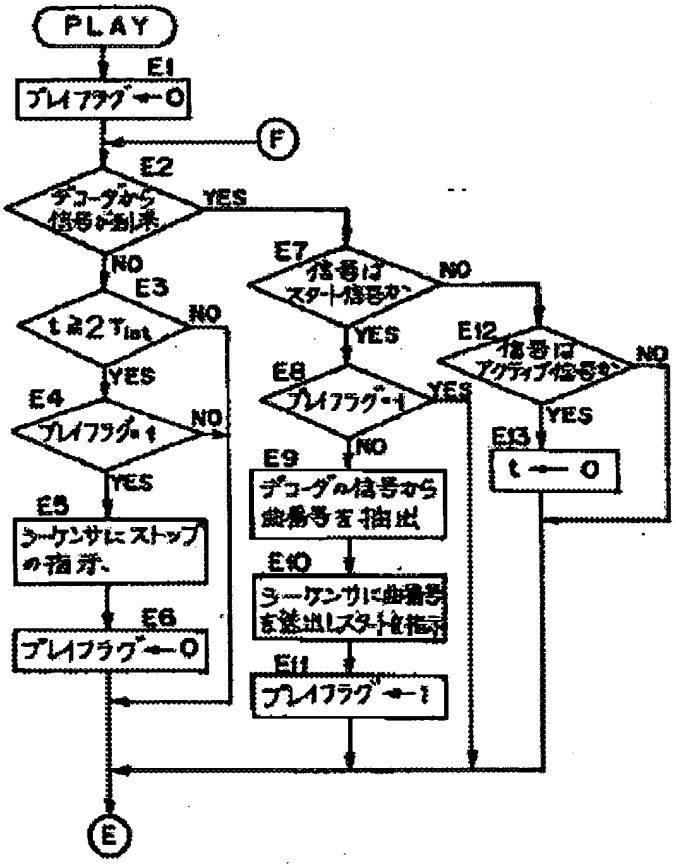

Figure 11. PLAY mode routine (1/2)

Key:
- E1 PLAY FLAG ← 0
- E2 SIGNAL ARRIVED FROM DECODER?
- E4 PLAY FLAG = 1 ?
- E5 INSTRUCT SEQUENCER TO STOP
- E6 PLAY FLAG ← 0
- E7 IS SIGNAL START SIGNAL?
- E8 PLAY FLAG = 1 ?
- E9 EXTRACT SONG NUMBER FROM DECODER SIGNAL
- E10 SEND SONG NUMBER TO SEQUENCER, INSTRUCT TO START
- E11 PLAY FLAG ← 1
- E12 IS SIGNAL ACTIVE SIGNAL?

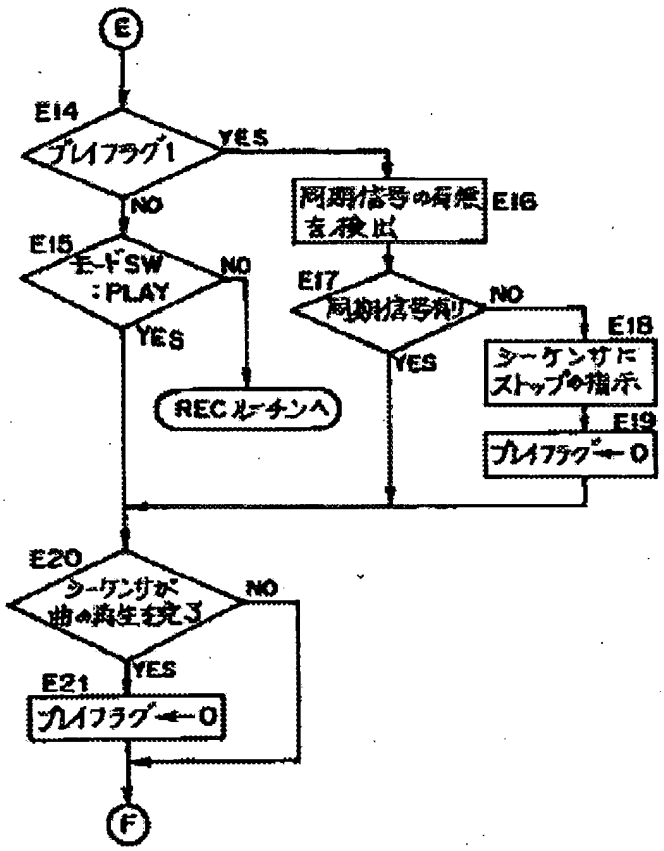

Figure 12. PLAY mode routine (2/2)

Key:
- E14 PLAY FLAG = 1 ?
- E15 MODE SW: PLAY?
- NO (TO REC ROUTINE)
- E16 DETECT SYNCHRONIZATION SIGNAL
- E17 SYNCHRONIZATION SIGNAL?
- E18 INSTRUCT SEQUENCER TO STOP
- E19 PLAY FLAG ← 0
- E20 SEQUENCER DONE WITH SONG PERFORMANCE?
- E21 PLAY FLAG ← 0

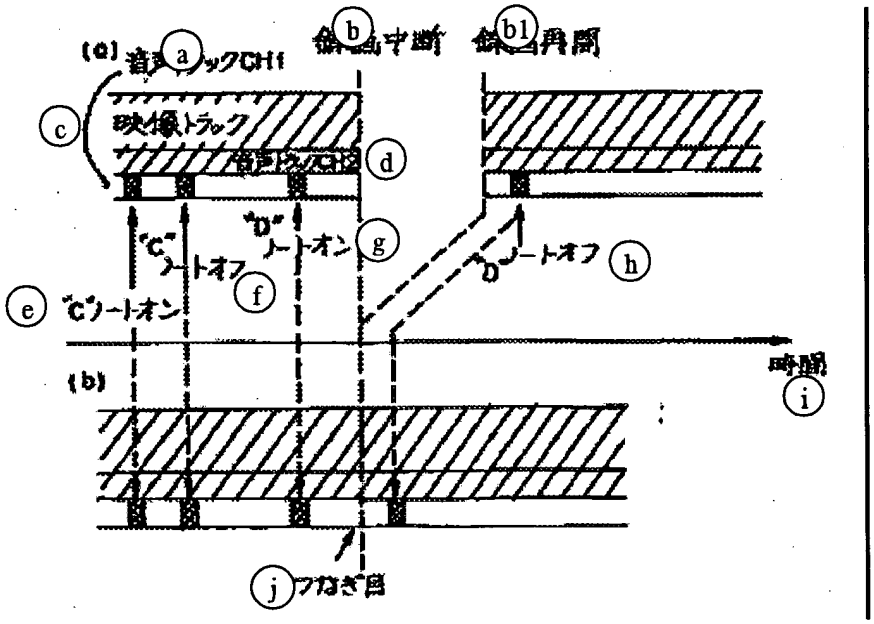

Figure 13

Key:

a	AUDIO TRACK CH1
b	PAUSE VIDEO RECORDING
b1	RESTART VIDEO RECORDING
c	VIDEO TRACK
d	AUDIOT TRACK CH2
e	"C" NOTE ON
f	"C" NOTE OFF
g	"D" NOTE ON
h	"D" NOTE OFF
i	TIME
j	SEAM